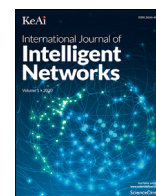




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The role of cloud computing technology: A savior to fight the lockdown in COVID 19 crisis, the benefits, characteristics and applications

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ABSTRACT

The contagion of the Coronavirus (COVID-19) led to a global lockdown that put governments in emergency mode. With the total number of positive cases worldwide exceeding the 97.46 million mark, social distancing appears to be the only effective strategy to contain the virus at the moment. As a result, companies face obstacles and find it difficult to respond to this current challenge of remote working. The impact of the novel COVID-19 has created many new challenges, and many of us have had to adopt new ways of working. With the need for accessing to critical applications and the scalability of the infrastructure, cloud computing is emerging as an underlying technology. The cloud technology had a major role in fighting the epidemic; it becomes a salvation for governments and organizations in numerous fields of life, education, health, industry, communication, remote surveillance, and more information. Therefore, this study presents the benefits, characteristics and applications of cloud computing and explains how the cloud contributes to improving life in all regions of the world during COVID-19. It shows that the cloud computing helps countries in combating COVID 19, in education and health sectors, also in the economic and commercial aspects. It investigates the current state by distributing an online questionnaire to various people of academic and non-academic backgrounds in different places over the world in the ICT and education sectors. The results showed that there is an effective role for cloud computing during the epidemic.

1. Introduction

The Cloud Computing has been increasingly growing in recent years. This growth has been achieved on the back of both innovation and expansion in the area of cloud powered solutions to the information technology industry offering a modern way to handle different information systems. There are several features of enterprises that are heading into cloud-based data storage solutions. They include a simplified IT technology and administration, efficient remote connectivity from everywhere in the world with a secure internet connection and cost-effective cloud storage as shifted into the idea of on-demand delivery, pooling of resources and integrating everything in the delivery environment [1].

Since the (COVID-19) has really shattered investor confidence and turned our lives upside down, the technologies have become our saving

grace. One of the solutions is that the workers should work remotely. However, companies face obstacles and find it difficult to respond to this current challenge of remote working. And other companies find it difficult to cope with the new phenomenon. For example, enterprises that invested in a cloud computing infrastructure exceeded the current pandemic are functioning well. Therefore, cloud computing helps employees and co-workers collaborate and communicate safely with each other in a remote environment. While other organizations lacking a cloud computing infrastructure find it difficult to run smoothly. The cloud computing reduces the challenges of operating remotely such as chatting, interacting and tracking all the work from home safely [2].

In addition, during the (COVID-19) period, cloud technology played a major role in fighting the epidemic, i.e. it becomes a salvation for governments and organizations in numerous fields of life, education, health, industry, communication, remote surveillance, and more information.

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Tech companies become, as a straw under the sun shines, more reliant on delivering their works from home and stay productive. For instance, in a blog post CEO of Google Cloud, spoke about the increased demand for these services “Over the past few weeks, Meet's daily growth rate has exceeded 60%, and as a result, its daily use is 25 times more than it was in January”. In a positive development, Google revealed in the same article that advanced features in Google Meet are now free for both G Suite and G Suite for Education customers around the world. During the pandemic, he also announced new locations for Google Meet hardware in “South Korea, Hong Kong, Taiwan, Indonesia, and South Africa,” to ensure consumers have the correct hardware to complement the Meet solution. Remote staff as a service was introduced in collaboration with AWS, Microsoft Azure, Google Cloud Platform, Alibaba Cloud, and 3i Infotech. By hosting any local applications or servers, a virtual private network (VPN) as a service makes it simple to operate remotely. It also enables organizations to transfer to the cloud easily [3].

Cloud computing represents a fundamental pillar for helping the countries for fighting the COVID 19 in the education, telehealth, economy, and business.

1.1. Problem of the study

The impact of the novel coronavirus (COVID-19) outbreak has led to a global lockdown, putting countries on high alert. With more than 97.46 million positive cases globally, social separation appears to be the only viable approach to enclosing the virus at present. As a result, organizations face challenges and find it difficult to adapt to this new challenge of working remotely. The (COVID-19) has created many new challenges which made us to embrace new ways of working. With the need to access critical applications and infrastructure scalability, cloud computing is emerging as a core technology. Cloud computing has become the need of the hour. The cloud has been a big part of our war against the epidemic in various areas of life.

As presented previously, the study problem can be formulated in the following main question:

What is the role cloud computing application in assisting the community to mitigating the effects of the epidemic?

How successful was the experience of using cloud computing as a savior to fight the COVID 19 lockdown in the help of the countries in the education sector?

The following sub-questions are emerged from the main question:

- What is the percentage of users' satisfaction with the cloud services during the COVID 19 lockdown period?
- What is the availability of the most common cloud applications used during the COVID 19 lockdown period?
- What is the nature of cloud computing techniques used as a savior during the COVID 19 lockdown period?
- What are the benefits of applying cloud during the COVID 19 lockdown period?
- Are the government sectors and the private organization sectors planning to transfer to the cloud computing?

1.2. Objectives of this study

The main objective of this study is to assess the experience of how cloud computing has been a lifesaver to fight the lockdown during the COVID 19 crisis.

The following sub-goals emanate from the main objective:

- Knowing the basic structure of cloud computing.
- Contributing cloud computing to improve life in all over the world during COVID 19 lockdown period.
- Determining the nature of available cloud computing technique to support countries in fighting the COVID pandemic, especially in the educational sector.

- Learning about aspects of the benefits of applying cloud computing during the COVID 19 lockdown period.
- Measuring the level of planning of the government sectors and the private organization sectors to move to the cloud computing.

1.3. The importance of study

The importance of this research stems from the importance of cloud computing as a new technology and an effective method of conducting business. This evaluation study comes in a parallel line with the global challenge. The importance is also exploring and evaluating the experience that comes in exceptional circumstances and faces a serious challenge in the world.

Accordingly, the aspects of benefiting from this study can be described in the following points:

1. Describing the advantages of cloud computing, its characteristics, and its applications in different areas of life during the COVID 19 crisis.
2. Assisting officials and decision-makers to take the appropriate decisions for employing educational technology and forming it to benefit from it in the future.
3. The study is important to researchers and those who are interested in evaluating experiences in the field of cloud computing.

1.4. The scope of the study

The online questionnaires are distributed via Google Docs to a government university, educational institutions, colleges of applied sciences, private universities/colleges of technologies and employees who work in ICT in different countries.

The rest of the paper is organized as follows. Section (2) presents some remarks on the COVID-19 crisis. A brief overview of cloud computing is provided in Section (3). Section (4) presents some remarks on related work. The main part of the paper is section (5), which is devoted to several issues related to the scientific framework of the study of using cloud computing service during the COVID 19 lockdown crisis. Section (6) shows the results and discussion. The conclusion and further recommendations will be highlighted in section (7).

2. Overview of COVID 19 crisis

This section describes the brief information of COVID 19 crisis and also its impact on education sector.

2.1. Interdiction of COVID 19 crisis

Coronavirus is a single-stranded RNA virus with a coat and is about 0.1 μm in diameter. The virus is spread through droplets such as coughing, direct contact with an infected person, or hands touching contaminated environmental surfaces. The COVID-19 pandemic is the defining public health crisis of our time and the largest threat that faced the humanity since the Second World War. First it appeared in Asia at the end of last year and then spread in all the world. This pandemic is even more than a health crisis stressing on many countries; it has the ability to cause devastating societal, economic and political consequences that can leave deep and long-standing scars. Every day, people lose work and wealth, with no way to tell when normality is going to return. The International labor organization reports that 195 million jobs could be lost [4].

According to Geneva [5], January 24th./The TASS/. The World Health Organization (WHO) announced in its daily Sunday Newsletter that more than 577,000 confirmed cases of coronavirus were registered worldwide last day, with a cumulative number of these cases reaching 97.46 million. Up to 97,464,094 cases of coronavirus infection were recorded on January 24, 2021. According to the WHO, the north and South America account for more than 56% of the daily COVID-19 toll

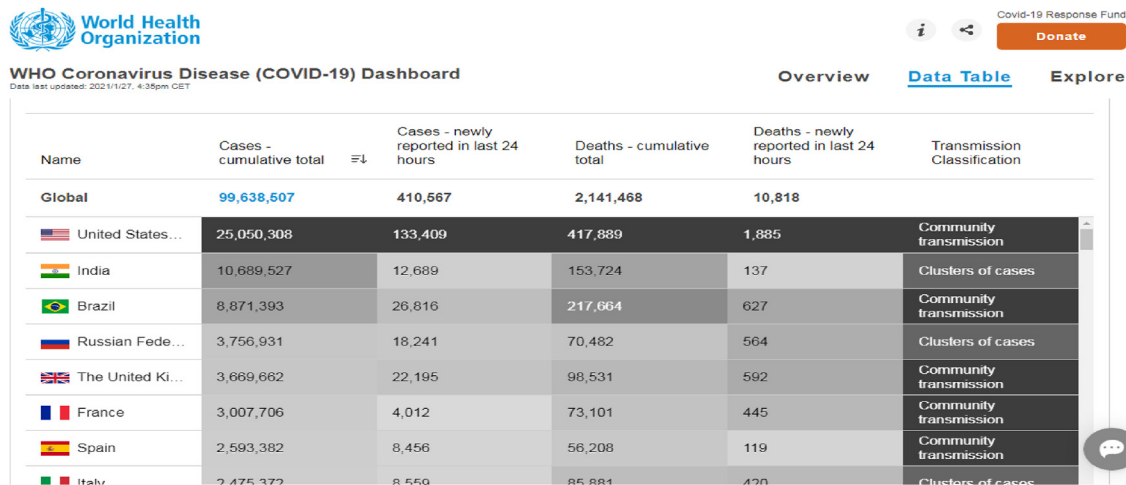


Fig. 1. WHO (2021).

(323,950 cases). It is followed by Europe (166,047 cases) and Southeast Asia (29,198 cases). The largest numbers of coronavirus cases were reported from the United States (24,604,325), India (10,654,533), Brazil (8,753,920), Russia (3,719,400), the United Kingdom (3,617,463), France (2,985,259), Spain (2,456,675) and Italy (2,455,185), Germany (2,134,936), Colombia (1,987,418), Argentina (1,853,830) and Mexico (1,732,290) As shown in Fig. 1.

2.2. Impact of covid-19 on education sector

The COVID-19 pandemic is first and foremost a health crisis. Many countries have decided to close schools, colleges and universities [6–9]. The epidemic encapsulates the challenge that politicians face in deciding whether to close schools (to reduce interaction and save lives) or to leave them open (allowing workers to work and preserving the economy). In the short term, many households around the world are experiencing this major disruption: home schooling is a massive blow not just to parental productivity, but also to children's social lives and learning. In an unprecedented and untested rate, education is going online. Many of the tests have been cancelled outright. Importantly, these disruptions may not only be a short-term problem, but they may also have long-term consequences for the affected groups, increasing inequalities [10].

2.2.1. Impacts on education: schools

Going to school is the most effective public policy instrument for improving skills. Although education can be enjoyable and can help children develop social skills and knowledge, the most important economic benefit of being in school is that it improves a child's potential. And if it's only for a brief amount of time in school, even a short period of absence from school would have implications for ability growth. Should we, therefore, quantify the learning effect of boycotting COVID-19? We can't be precise since we're in a new country, but we can get an order of magnitude from other research.

2.2.2. Impacts on education: families (side)

Perhaps to some people's dismay, children are usually not sent school to learn. The suggestion is that they finish their schooling at home, hoping that they don't miss much. As defined by Author [11], families are an integral component of education and are generally accepted to provide key inputs to a child's learning. The new global growth in home-schooling can be regarded favorably at first glance, as it is likely to be effective. However, this function is typically seen as a supplement to the school's input. Parents can supplement a child's arithmetic learning by counting for them or highlighting basic math problems in daily situations; they can also enrich history lessons by taking them to important

monuments or museums. It's a different issue to be the primary force of literacy, even with online materials; while many parents around the world actively teach their children at home, this is impossible to apply to the entire population. So, while global homeschooling will undoubtedly yield some exciting, furious, enjoyable, and stressful moments, it is unlikely that it will replace learning lost from school on a consistent basis. But the bigger point is that there are likely to be significant differences between households in terms of their ability to assist their children in learning. The amount of time required to devote to instruction, non-cognitive abilities for parents, tools (for example, not all would have a toolkit to find the right materials online), and the amount of expertise accessible are the key disparities. -It's difficult to assist your child in this area. Learn something that you may not be able to figure out on your own. As a result, the affected cohorts will see increased inequalities in human capital development as a result of this cycle.

- Assessments

The closure of schools, colleges, and universities not only results in a worldwide boycott of teaching; it also coincides with a significant assessment cycle, which has resulted in several exams being delayed or cancelled. Internal reports are probably regarded as less significant, and many have been cancelled as a result.

- Graduates;

The COVID-19 pandemic will have a significant impact on this year's college degree jobs. They have had significant disruptions in teaching in the latter stages of their studies, are seeing major disruptions in their assessment, and are about to graduate at the start of a major global recession.

3. Overview of cloud computing

3.1. Cloud computing concepts

The NIST Definition for Cloud Computing private deployment is a paradigm for providing ubiquitous, ergonomic, and on-demand network access to a shared collection of configurable computing resources (such as software, utilities, storage, networks, and servers) that can be rapidly provisioned and released with minimal effort. There is less contact with the support staff or service providers. Scalability, manageability, and flexibility are all advantages of cloud computing. Cloud infrastructure also has the advantages of on-demand operation, economy, universality, comfort, leasing pluralism, reliability, and versatility. A cloud customer

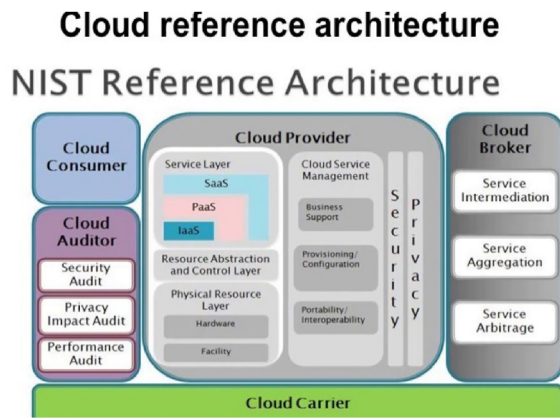


Fig. 2. Reference architecture of Cloud computing with different deployment models [19] [55].

can use these resources on demand to flexibly develop, operate and host applications and services anytime, anywhere and on any device. According to the NIST definition, it highlights the three service models - Platform as a Service (PaaS), Program as a Service (SaaS), Infrastructure as a Service (IaaS), and cloud service delivery through a Cloud Service Provider (CSP) to its customers as explain in Fig. 2. It also summarizes the four deployment models - public cloud, hybrid cloud, private cloud, and community cloud, while highlighting the computing infrastructure sharing model for delivering cloud services. Moreover, it provides an integrated view of five essential and unique features of each cloud service - resource pooling, self-service on demand, rapid flexibility, scaled services, and wide network access [11–13].

3.2. Cloud service delivery models

With the development of internet technology and cloud computing for big data, they elevated a new concept of services. These new services can link the growing number of online activities. After many types of research in cloud computing that basically provide three service delivery models and four development modes which are IaaS, PaaS and SaaS, there are currently many service models available according to their service that provide the functions and capabilities that lead to the creation of anything like - anything as a service (AaaS) delivery models". The following describes service delivery models (SaaS, PaaS, and IaaS) for

delivering cloud services by a cloud provider to its customers [14].

- Infrastructure as a Service (IaaS) belongs to the bottom of the paradigm. IaaS deals with computer hardware (processor, memory, network storage, server/virtual machine, and data center) as a service.
- Platform as a service PaaS is present in the middleware of the service model and provides services in the form of development, tools, framework, architecture, software, and IDEs.
- Software as a Service (SaaS) is a combination of remote computing services. SaaS is in the top of the line among delivery models. Remote deployment of applications by a third party is allowed.

3.3. The core component of cloud computing

This section, discusses the basic components of cloud computing. These components consist of a wide range of services that can be used all over the internet.

- **Virtualization:** It plays a crucial function in cloud deployment. It is a critical component of the cloud that enables many users to share physical resources. It provides a simulated instance of a resource or unit, such as an operating system, servers, network infrastructure, or storage devices that the application can use in several execution environments [9].
- **Multi-tenancy:** Multiple clients or consumers in a multi-tenant system do not view or share each other's data but can share resources or applications in an implementation environment, even though they do not belong to the same entity. Multi-tenancy helps in the most efficient use of hardware and data storage mechanisms [9].
- **Cloud storage:** It is a component, which maintained, managed, and backed up remotely and it made available over the network where the users can access data.
- **The hypervisor:** A core component of virtualization is the virtual machine monitor or boss. It enables the execution of several Virtual Machines (VMs) on a single hardware host. It controls and tracks the various operating systems that share a physical system [15].
- **Cloud Network:** It can operate more than one conventional data centers; a typical data center contains hundreds or thousands of servers [15]. To efficiently build and manage the storages the cloud requires a secure network infrastructure called cloud networking. It requires an internet connection and similar with a virtual private network which enables the user to securely access printers, applications, files etc.

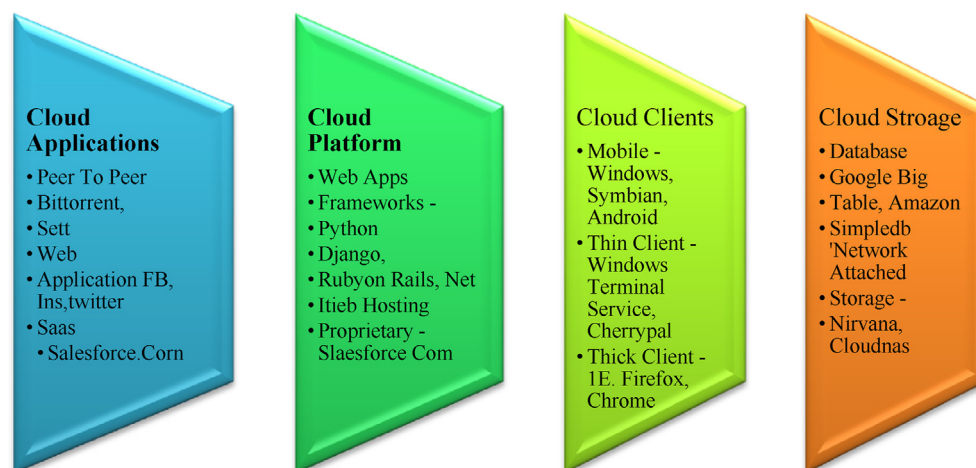


Fig. 3. Main components of cloud computing.

3.4. Cloud computing components vitality during COVID-19

In the current COVID-19 pandemic condition, cloud computing services may be readily deployed and exploited, allowing facilities such as data management, recording information, and so on to become more productive [16].

To fulfil the cloud computing approach's intended purpose, it requires the significant elements/components to be organized together. The main components were summarized and explained in Fig. 3. Cloud clients are software/computer setups that are designed primarily to use cloud services, whereas cloud services are solutions, products, and services that are used for real-time delivery. Cloud apps are used in cloud software architecture so that medical staff may access shared data; nevertheless, a cloud platform is a type of service that includes software infrastructure and services [16,17]. All records, patient shareable reports, information, and other data are stored in the cloud, and cloud infrastructure is the provision of computing infrastructure as a facility/service in the domain of interest.

3.5. Application of cloud computing

Cloud computing has swept the digital globe since its inception. Cloud computing is the practice of managing, storing, or processing data on a network of remote servers hosted on the Internet. Previously, this data had to be stored on local servers or personal computers, which restricted storage space. However, with cloud computing, it is possible to access almost infinite space while still improving remote processing. Cloud computing's potential has expanded considerably as a result of optimized resource use, flexibility, cost reduction, and flexibility. Machine learning in the cloud has a number of advantages. Furthermore, cloud computing applications have grown to including mobile phones.

4. Related work

In addition to a number of researches examining the effective role of technology in trying to reduce the impact of the pandemic on society as a whole, many studies have been conducted on how COVID-19 effects in all aspects of life. The next subsections describe briefly the related works on how COVID 19 influences our lives in the society and show the roles of the technology in reducing these impacts of the pandemic on society.

4.1. COVID 19 and its impacts on the society

According to Ref. [18] the emerging coronavirus, known as Covid-19, was discovered in the last month of 2019 year, at a seafood market in Wuhan. Shown the results of the clinical analysis of the virus person-to-person transmission.

The World Health Organization (WHO) in march 2020 (WHO, 2020) declared that COVID-19 has become a pandemic after an evaluation the speed of the spread and severity of the deadly virus worldwide with additional announcements about social distancing as a way to limit the spread of the epidemic. Social distancing is a conscious increase in the physical gap between people in order to limit the spread of disease (Red Cross, 2020). This pandemic has forced the global physical shutdown of business, sporting activities and schools by forcing all institutions to migrate to online platforms [5].

The paper [19] aims to study the repercussions of the Coronavirus on various sectors of the economy, highlight the reasons for India's benefit in the post-pandemic period, and identify mainly business survival strategies that are key to overcoming this difficult situation. Whereas, paper [20–22] highlights some of the country's seamless education. The positive and negative impacts of COVID have been discussed, and some fruitful suggestions for implementing educational activities during COVID 19 have also been noted.

The authors [23] have studied the impact of COVID-19 on health sector prevention and treatment services for non-communicable diseases

(NCDs) have been severely disrupted since the COVID-19 pandemic began, according to a WHO survey released during the pandemic. Whereas, the authors [7] focused on the impact of COVID-19 on economic sector, the outbreak of pandemic COVID-19 all over the world has disturbed the political, social, economic, religious and financial structures of the whole world.

Authors [8] have study the impact of COVID-19 on education sector. The COVID-19 pandemic is first and foremost a health crisis. Many countries have (rightly) decided to close schools, colleges and universities.

4.2. Roles of the technology in reducing the impact of the pandemic on society

The technology has been reducing the impact of the pandemic on society. The paper [24] discusses immigration of higher educational institutions, students and faculty as response to the pandemic from normal learning to online learning. The opportunities and challenges related to COVID-19 have added values to the current body of literature by online learning and providing comprehensive awareness of immigration methods to avail an appropriate mode of communication between the institutions and students. The authors in [25] add some light on the growth of E-Tech Start-up during a time of pandemic and natural disasters and include suggestions for academic institutions on how to deal with the challenges associated with online learning. Whereas paper [3] explains the role of IT Governance during the COVID-2019 Pandemic. The authors study the cloud's significance in enabling remote data access and storage which have become even more demonstrable in light of the COVID-19 situation, enabling business continuity and avoiding risk [26].

5. The scientific outline of the study

The survey was conducted in four parts, and it was distributed to participants from different nationalities. The first part is general information about the participants. The second part evaluates participants' knowledge of cloud computing. The third part is used to evaluate the adoption of cloud computing in participants' organization through the COVID 19 lock-down. It evaluates the main concerns in adopting cloud computing in their institution. The sufficient knowledge to use the cloud computing is approved; this made the ability to use the cloud within pandemic is permitted and displays the users' satisfaction with cloud service to get benefits of cloud applications in this period. The last part of this survey measures the need for cloud computing in the future. The following subsections show the methodology and sample design.

5.1. Research methodology

Exploratory, descriptive, empirical, and statistical analysis approaches are the four categories of research methods. Descriptive analysis is useful for identifying and categorizing elements or characteristics of a subject [Neville, 2007]. According to Creswell [1994], a descriptive system of analysis is used to gather knowledge about the current situation.

In this paper, the researchers used the descriptive exploratory approach appropriate for the objectives of the study, and this method helps the researchers to form a more accurate perception, and enables them to form a general framework that helps in conducting a deeper study later. In addition to what is mentioned above, it ensures whether cloud computing service was a savior to fight the lockdown in COVID-19 crisis, benefits, characteristics, and applications.

5.2. Design sample

The sample design was created in electronic form with Google docs and selected randomly from different educational institutions and ICT. The sample was 101 participants from 16 different countries from

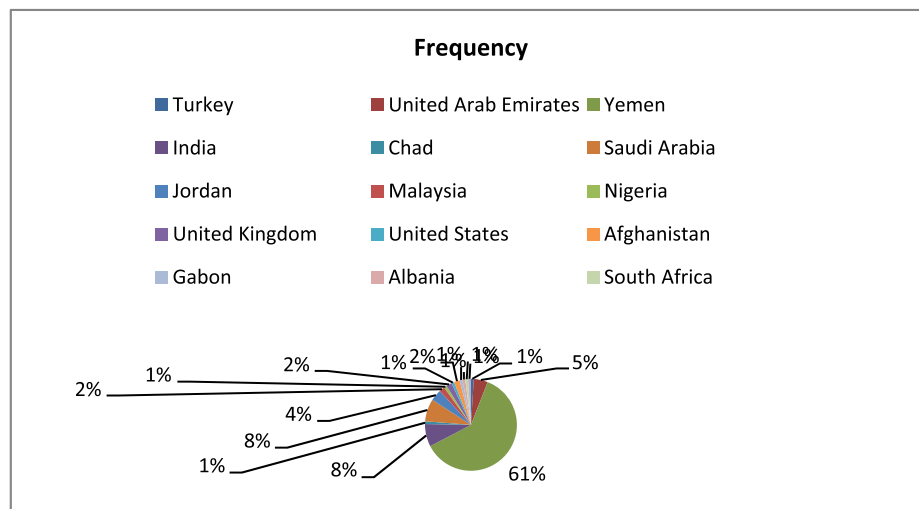


Fig. 4. Distribution frequency upon the questionnaires nationality.

October 2nd to November 2nd, 2020.

5.3. The study tool

The researchers designed forms to collect data from the study sample, and the questionnaire included a set of questions according to the objectives of the study. It was taken out after verification of its validity and reliability. The online questionnaire contains (37) questions divided into four parts:

- ✓ Part one: contains general information about participants.
 - a. Personal information (nationality, age),
 - b. Socioeconomic data (designation of respondent, level of education, place of work, years of work experience).
- B.1 Designation of the respondent classified into three classes: Academic (faculty member), non-academic, other.
- B.2 Level of education considered into five subclasses: Prof./PhD., Master, Bachelor, Diploma, Other.
- B.3 Place of work is considered into five subclasses: education sector, health sector, management and administration, business, Other.
- b.4 Years of work experience classified into four subclasses: 1–5 year, 6–15 year, 15–30 year, Over 30 years.
- ✓ Part two: specifies the participant's knowledge of cloud computing.
- ✓ Part three: checks cloud computing service at the institutions and organizations government and non-government in COVID 19 lock-down period.

- ✓ Part four: displays the users' satisfaction with cloud service and the benefits of cloud applications in this period.

5.4. Data analysis tool

The Statistical Package for Social Sciences (SPSS) version 25 [26] was used to tabulate metadata including basic characteristics and the field of the questionnaires. The computational method adopted to determine the general direction of the participants regarding the questionnaire.

6. Results and discussion

The results will be presented and discussed according to the study questions using ratios, frequencies, arithmetic mean and relative weights. The reliability analysis (stability, internal consistency) measured by Cronbach's alpha, the questionnaires contains 0.951 reflecting the excellent stability at the same time Cronbach alpha of the elements in four parts less than 0.951. So that the internal consistency is satisfied.

The result showed that the sample are distributed such that the participants from Yemen 61.4%, Saudi Arabia and India at 7.9% for each and 22.8% for other countries as seen in Fig. 4.

The sample results show that the half of the participants between 30 and 39 years old, 24% for whom between 20 and 29 years old, the 40–50 years old are 19.8% and 5% for 50 years old above.

Most common in respondent assignment is academic participant

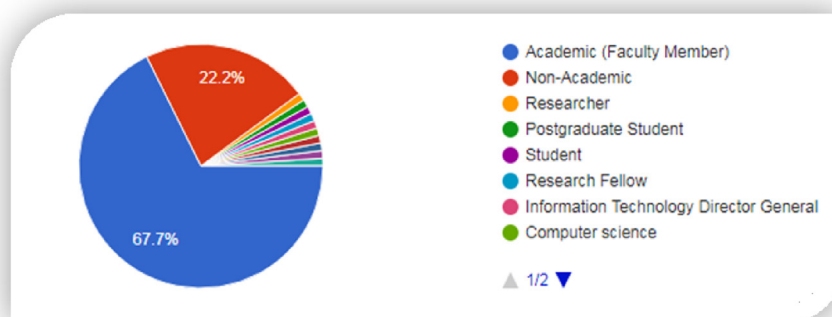


Fig. 5. Distribution frequency Designation of Respondent.

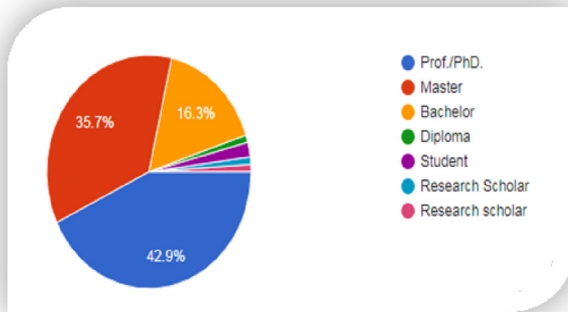


Fig. 6. Distribution frequency education level and prevalence of the workplace.

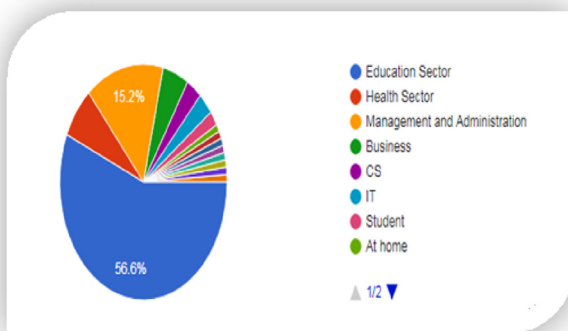


Fig. 7. Distribution frequency of type(s) of cloud services.

(faculty member) 67.3%, 22% non-academic and 11% in other assignments. The education level of most of the participants was 41.6% professor/doctorate, while 36.6% were masters, bachelors 14.9%, diplomas were 1% and others 5.9%. as seen in Fig. 5.

As the lowest prevalence of the workplace, the participants in which are almost working in the education sector, 16.8% in management and administration, and others 15.8%, in the health sector, 5.9%, and less in business, at 5%. Whether the most common work experience years were 57.4% such as 1–5 years, 6–15 years were 29.7%; 6–15 years were the

least 12.9%. as seen in Figs. 6 and 7

The result of percentage of overall participant's knowledge sufficiently about the cloud computing, score was 52.5% ($n = 53$), and they agreed that public information about cloud computing is known. The average score for questions concerning participants' knowledge about cloud computing from 3.72 ± 1.031 to 3.82 ± 1.014 (as seen in Table 1). As seen in Table 1, most of the respondents have good knowledge about Cloud Computing and cloud computing application score was 19.6% ($n = 19$) strongly agree and score of Agree was 43.3%, ($n = 43$). And also, the result show percentage of appropriate of used any cloud applications score was 98%. The research tries to clear the participant's reply about the most field used the cloud applications by participant's as showed in Table 1.

The result of percentage appropriate public respondents who used and accredited cloud computing in their organization on the COVID 19 lock-down, score was 72.3% ($n = 73$), and they agreed that their organization adopted cloud computing in COVID 19 lock-down (see Fig. 8).

Also percentage appropriate public respondents to the main question (Do you think implementing Cloud Computing in your organization or institution will improve the quality of delivering services?) score was 32% Strongly agree, 45.8% Agree, 11.9% Neutral, and 10.2 Strongly disagree. The result of percentage appropriate of specify the type(s) of services that you are using in your institution as showed in Fig. 9.

Also The mean score for questions related to concerning participants' about used and adopting the cloud computing in their organization in the COVID 19 lock-down from 3.29 ± 0.852 to 3.93 ± 0.886 (as seen in Table 2).

The result in this section explain the main concerns in adopting cloud computing which are concerned with privacy and confidentiality of corporate data, security availability of services or data, the need for a stable and fast Internet connection, and Loss of control of services and/or data. All considered the main concerned to provide the good cloud computing service.

The percentage of the adequate overall participant for main concerns in adopting cloud computing in their institution score was 79.2% ($n = 80$), they agreed that their institution adopted the main concerns in cloud computing in the COVID 19 lock-down.

The mean score for questions related to concerning participants about the main concerns in adopting cloud computing in their institution from 3.24 ± 0.789 to 4 ± 0.787 (as seen in Table 3).

7. Conclusion

The epidemic diseases cause radical social changes during human history since long periods. Covid-19 has also dramatically changed the

Table 1

Frequency and mean \pm standard deviation (SD) of participants' questionnaire answers about knowledge about cloud computing.

Questionnaire part's items	Strongly agree N%	Agree N %	Neutral N %	Dis Agree N%	Dis Strongly agree N%	Mean \pm SD N%
You have a good knowledge about Cloud Computing.	22(21.8)	53(52.5)	14(13.9)	8(7.9)	4(4)	3.8 \pm 1
You have a good knowledge in cloud Computing Application.	22(21.8)	51(50.5)	14(13.9)	8(7.9)	6(5.9)	3.74 \pm 1.074
You have a good knowledge about IoT in cloud.	22(21.8)	49(48.5)	18(17.8)	8(7.9)	4(4)	3.76 \pm 1.011
you used any cloud applications (such as Zoom Cloud, Google Meeting, Microsoft Teams, Dropbox, Dell's Secure.	21(20.8)	51(50.5)	16(15.8)	9(8.9)	4(4)	3.75 \pm 1.014
In any field you used the cloud applications	25(24.8)	48(47.5)	17(16.8)	7(6.9)	4(4)	3.82 \pm 1.014
In your view of point do you feel that the Cloud Computing Application was the savior of us during the period of covid 19 lockdown?	21(20.8)	49(48.5)	17(16.8)	10(9.9)	4(4)	3.72 \pm 1.031
In your view of point, did the popularity of cloud use will be increased during this period of COVID 19?	22(21.8)	48(47.5)	19(18.8)	8(7.9)	4(4)	3.75 \pm 1.014
Did you get benefit from using Cloud Application?	22(21.8)	48(47.5)	19(18.8)	8(7.9)	4(4)	3.75 \pm 1.014
Do you agree with this statement "Cloud computing is the future successful model of IT in various life field?"	22(21.8)	52(51.5)	15(14.9)	8(7.9)	4(4)	3.79 \pm 1.003

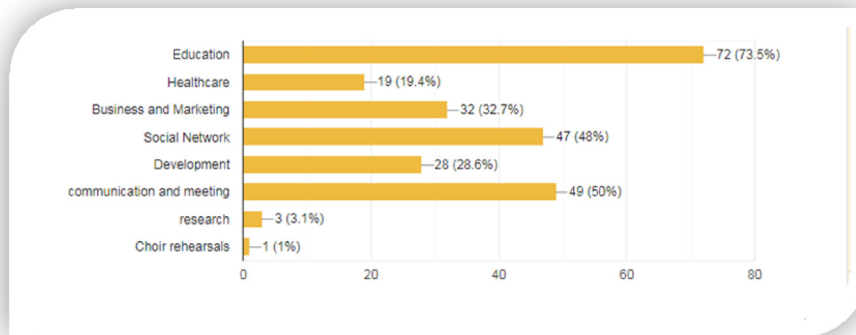


Fig. 8. Distribution frequency of in any field you used the cloud applications.

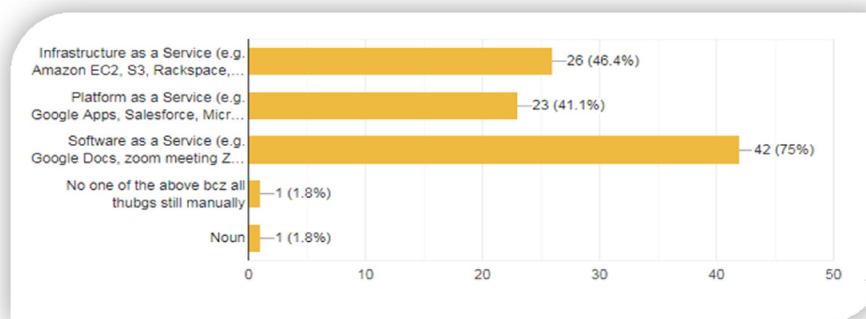


Fig. 9. Distribution frequency of type(s) of cloud services.

Table 2

Frequency and mean \pm standard deviation (SD) of participants' questionnaire answers about Used and adopting the cloud computing in their organization in the Covid 19 lock-down.

Questionnaire part's items	Strongly agree N%	Agree N %	Neutral N %	Dis Agree N%	Strongly dis agree N%	Mean \pm SD N%
There is availability of using cloud computing in your organization?	22(21.8)	53(52.5)	14(13.9)	8(7.9)	4(4)	3.81 \pm 0.868
Does your role influence your organization decision whether to adopt or not adopt cloud computing solution?	22(21.8)	51(50.5)	14(13.9)	8(7.9)	6(5.9)	3.29 \pm 0.852
Do you think implementing Cloud Computing in your organization or institution will improve the quality of delivering services?	22(21.8)	49(48.5)	18(17.8)	8(7.9)	4(4)	3.93 \pm 0.886

consumption habits of people around the world and continues to change. The current situation indicates that one of the most significant visual impacts of COVID-19 is imposed on a widespread digital social and business life. It had numerous impacts on the environment and nations. The technology has played an important role in mitigating the effects of Coronavirus pandemic. However, the most common shift between these factors is the pattern of technology and, in particular, cloud computing technology.

People avoided contacting each other as much as possible and tried to fulfil almost all of their online needs in using cloud computing technology during the period when the workplace was closed. This state of affairs led to significant improvements for companies, universities and schools all over the world. In the current situation, cloud computing has become necessary for educational institutions, companies and health facilities.

This paper reviewed a brief overview of the COVID-19 epidemic and how it has affected the world as a whole. It showed that the awareness of this topic practically justifies better knowledge of people and

deliberations about how the Coronavirus affects education, trade, industry, and economies in countries. The paper presented the benefits, characteristics, and applications of cloud computing. It explains how the cloud has contributed to improving life in all regions of the world during COVID-19. It shows that the cloud helps countries fight COVID-19 in education, business, and more. By distributing an online questionnaire to various academic and non-academic persons in different places around the world, The result in the first section showed percentage of overall participant's knowledge sufficiently about the cloud computing, score was 52.5% ($n = 53$), and they agreed that public information about cloud computing is known. Most of the respondents have good knowledge about Cloud Computing and cloud computing application score was 19.6% ($n = 19$) strongly agree and score of Agree was 43.3%, ($n = 43$). And also, the result show appropriate percentage of appropriate of using any cloud applications score was 98%. As seen in our questionnaire data analysis.

However the result showed that cloud computing played an important role in improving public life, especially in the field of education.

Table 3Frequency and mean \pm standard deviation (SD) of participants' questionnaire answers The main concerns in adopting cloud computing in their institution.

Questionnaire part's items	Strongly agree N %	Agree N %	Neutral N %	Dis agree N %	Strongly dis agree N %	Mean \pm SD N%
Privacy and Confidentiality of corporate data.	16(15.8)	69(68.3)	10(9.9)	3(3)	3(3)	3.91 \pm 0.801
Security	15(14.9)	73(72.3)	9(8.9)	1(1)	3(3)	3.95 \pm 0.740
Availability of Services and/or Data	17(16.8)	68(67.3)	11(10.9)	2(2)	3(3)	3.93 \pm 0.791
The need for a stable and fast Internet connection.	21(20.8)	66(65.3)	10(9.9)	1(1)	3(3)	4 \pm 0.787
Loss of control of services and/or data.	10(9.9)	22(21.8)	56(55.4)	9(8.9)	4(4)	3.25 \pm 0.899
Limited functionalities and options.	10(9.9)	66(65.3)	15(14.9)	7(6.9)	3(3)	3.72 \pm 0.850
Lack of liability of providers in case of security incidents.	5(5)	28(27.7)	57(56.4)	8(7.9)	3(3)	3.24 \pm 0.789
Difficulty of migration to the cloud (legacy software etc ...)	10(9.9)	69(68.3)	11(10.9)	8(7.9)	3(3)	3.74 \pm 0.856
The time of completely migrating the IT at institutions has arrived to cloud.	10(9.9)	72(71.3)	11(10.9)	5(5)	3(3)	3.8 \pm 0.8

Universities and schools have helped in the continuation of the learning process by using many cloud computing applications. As seen the participants' questionnaire answers about Used and adopting the cloud computing in their organization during the Covid 19 lock-down mostly give the good reply for the view of cloud computing service and the score was 72.3% (n = 73), and they agreed that their organization adopted cloud computing. as well as respondents' scores to the main question (Do you think implementing Cloud Computing in your organization or institution will improve the quality of delivering services?) score was 32% Strongly agree, 45.8% Agree, 11.9% Neutral, and 10.2 Strongly dis agree at the It also explained people's increased confidence in cloud computing technology.

The future direction study the risk effect to adopting the cloud computing in all organization also study the future of cloud computing in a post- COVID 19 pandemic all over the world from the users' point of view.

Declaration of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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